January 2001

Mathematics 33

Grade 12 Diploma Examination

Alberta LEARNING

Mathematics 33

Grade 12 Diploma Examination

Description

Time: This examination was developed to be completed in 2.5 h; however, you may take an additional 0.5 h to complete the examination.

This is a **closed-book** examination consisting of

- 37 multiple-choice and 12 numerical-response questions, of equal value, worth 70% of the examination

- 4 written-response questions worth 30% of the examination

This examination contains sets of related questions.

A set of questions may contain multiple-choice and/or numerical-response and/or written-response questions.

A mathematics data booklet is provided for your reference.

Note: *The perforated pages at the back of this booklet may be torn out and used for your rough work.*
No marks *will be given for work done on the tear-out pages.*

Instructions

- You are expected to provide a scientific calculator or a graphing calculator approved by Alberta Learning.   **NEW**

- You are expected to have cleared your calculator of all information that is stored in the programmable or parametric memory.   **NEW**

- Use only an HB pencil for the machine-scored answer sheet.

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.

- Read each question carefully.

- If you wish to change an answer, erase **all** traces of your first answer.

- Do not fold the answer sheet.

- The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Learning.

- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.

Multiple Choice

- Decide which of the choices **best** completes the statement or answers the question.

- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

Example

This examination is for the subject of

A. biology
B. physics
C. chemistry
D. mathematics

Answer Sheet

Ⓐ   Ⓑ   Ⓒ   ●

Numerical Response

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.

- If an answer is a value between 0 and 1 (e.g., 0.7), then be sure to record the 0 before the decimal place.

- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

Examples

Calculation Questions and Solutions

The value of tan 35° to the nearest tenth is _____ .

(Record your answer in the numerical-response section on the answer sheet.)

Calculator value: 0.7002075
Value to be recorded: 0.7

Record 0.7 on the answer sheet ⟶

The constant term in the quadratic function $y = 2x^2 + 7x + 32$ is _____.

(Record your answer in the numerical-response section on the answer sheet.)

Value to be recorded: 32

Record 32 on the answer sheet ⟶

3	2		

⊙ ⊙
⓪ ⓪ ⓪ ⓪
① ① ① ①
② ● ② ②
● ③ ③ ③
④ ④ ④ ④
⑤ ⑤ ⑤ ⑤
⑥ ⑥ ⑥ ⑥
⑦ ⑦ ⑦ ⑦
⑧ ⑧ ⑧ ⑧
⑨ ⑨ ⑨ ⑨

Correct-Order Question and Solution

Four angles given below are to be drawn on a coordinate plane in standard position.

1 750°
2 650°
3 460°
4 845°

When the principal angles corresponding to the above angles are arranged in order from **lowest** to **highest**, then the order is ___, ___, ___, ___.

(Record **all four digits** of your answer in the numerical-response section on the answer sheet.)

Value to be recorded: 1342

Record 1342 on the answer sheet ⟶

1	3	4	2

⊙ ⊙
⓪ ⓪ ⓪ ⓪
● ① ① ①
② ② ② ●
③ ● ③ ③
④ ④ ● ④
⑤ ⑤ ⑤ ⑤
⑥ ⑥ ⑥ ⑥
⑦ ⑦ ⑦ ⑦
⑧ ⑧ ⑧ ⑧
⑨ ⑨ ⑨ ⑨

Written Response

• Write your answers in the examination booklet as neatly as possible.

• For full marks, your answers must address **all** aspects of the question.

• Descriptions and/or explanations of concepts must be correct and include pertinent ideas, diagrams, calculations, and formulas.

• Your answers must be presented in a well-organized manner using complete sentences and correct units.

ALBERTA INDUSTRY

Mathematics is used in various ways in the Alberta oil industry. This set of questions is related to an oil company at its plant and well sites.
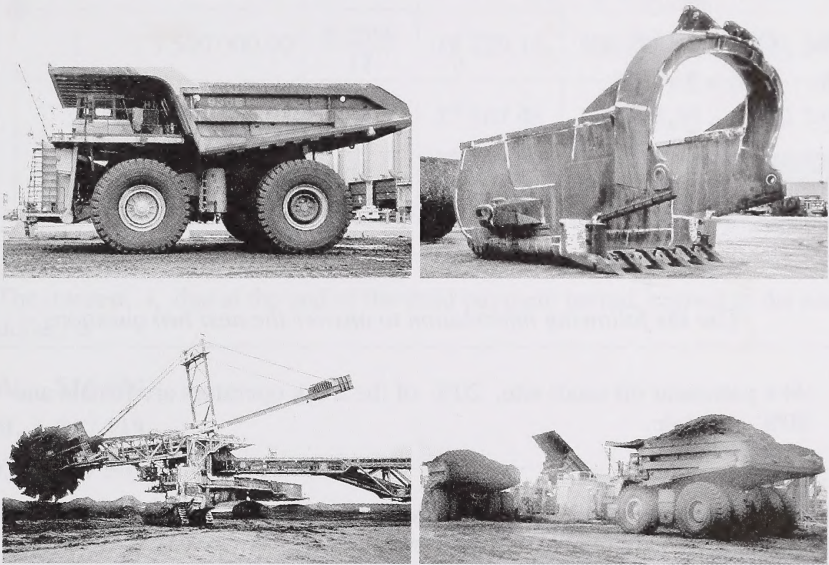
A large truck used at an oil sands site has a cost per trip that includes a flat rate of $2.00 plus an additional 14¢ for every kilometre driven.

1. The equation that represents the cost per trip, C, in dollars, as a function of distance, d, is

   A. $C(d) = 2.14d$
   B. $C(d) = 2 + 14d$
   C. $C(d) = 2 + 0.14d$
   D. $C(d) = 0.14 + 2d$

At a particular oil sands site, 20% of the truck operators are female and 80% are male.

2. If 40 truck operators were randomly sampled, the 90% confidence interval for the number who are female will be between

   A. 2 and 15
   B. 3 and 10
   C. 4 and 12
   D. 8 and 30

3. On a particular day, 20 truck drivers are working at the site. If a 90% confidence interval is assumed, which of the following samples is **unlikely** for the population of truck operators?

   A. 11 males, 9 females
   B. 13 males, 7 females
   C. 16 males, 4 females
   D. 19 males, 1 female

2

To purchase a new dragline, an oil sands company takes out a three-year loan of $3 500 000 at 6.25% per annum, compounded monthly. An amortization table for this loan has been started below.

Payment Period	Monthly Balance ($)	Rate	Interest ($)	Payment ($)	Balance ($)
1	3 500 000.00	$\frac{6.25\%}{12}$	18 229.16	106 873.55	3 411 355.61
2	3 411 355.61	$\frac{6.25\%}{12}$	17 767.48	106 873.55	3 322 249.54
3	3 322 249.54	$\frac{6.25\%}{12}$	i	106 873.55	

4. The interest, i, due at the end of the third payment period, correct to the nearest dollar, is

A. $16 434

B. $17 118

C. $17 303

D. $205 419

The company requires that the length of a dragline's boom be between 85 m and 90 m. A diagram of a new dragline, where $\overline{AD}$ represents the boom, is shown below.

Dragline
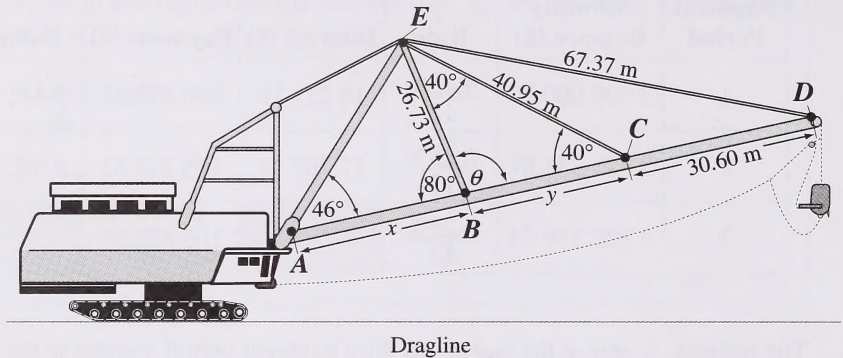
Written Response—6 marks

1. **a.** The measure of angle θ in $\triangle EBC$, to the nearest degree, is _____°.

b. Determine length y to the nearest tenth of a metre. Justify your answer.

c. Calculate length x to the nearest tenth of a metre. Support your answer algebraically.

d. Determine the total length of the boom to the nearest hundredth of a metre, and explain whether it will meet the company requirement.

The depth, S_d, in centimetres, that a new building will settle is related to the soil shear conditions, μ, by an equation called Poisson's ratio:

$$S_d = 2.3(1 - \mu^2)$$

The soil around a particular building at an oil sands site has a shear value of $\mu = 0.3$.

Numerical Response

1. The depth, S_d, that this building can be expected to settle, correct to the nearest tenth of a centimetre, is _____ cm.

(Record your answer in the numerical-response section on the answer sheet.)

The relationship between fuel consumption and temperature of a running engine is shown below.
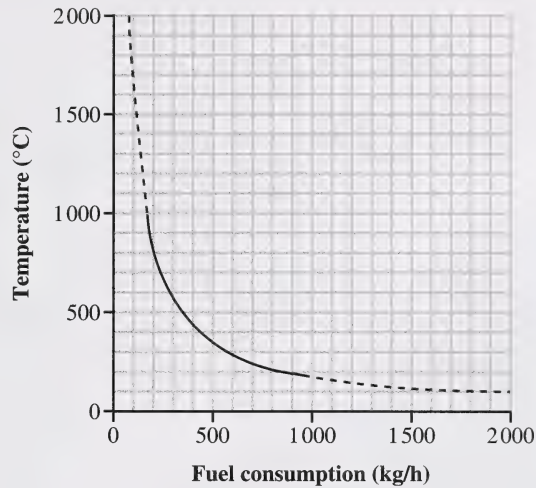
5. The graph above **best** represents

A. a linear function
B. a quadratic function
C. a reciprocal function
D. an absolute value function

A particular bucket wheel reclaimer has 14 buckets on a wheel that rotates 1 440°/min. Each bucket scoops 3 m^3 of soil.

Bucket wheel reclaimer

Direction of rotation

Conveyor belt

Soil to be reclaimed
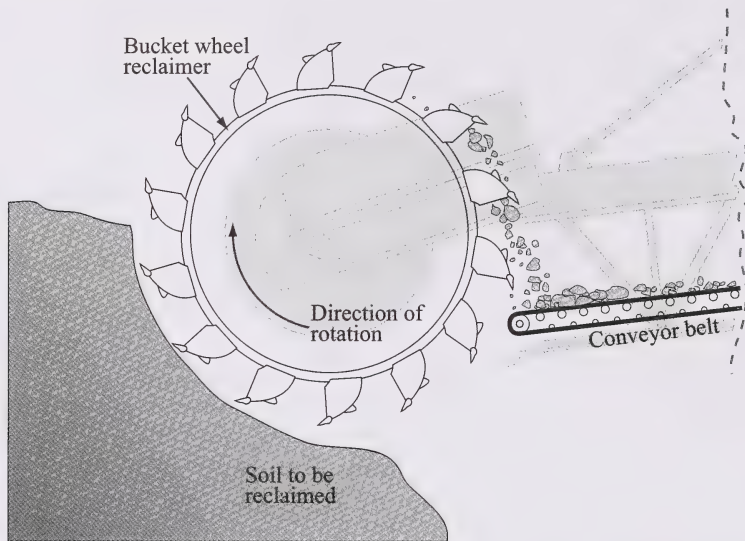
6. The total amount of soil scooped every minute, correct to the nearest cubic metre, is

A. 42 m^3

B. 168 m^3

C. 309 m^3

D. 60 480 m^3

At an oil sands site, a piece of equipment is attached to a steel cable and dragged by a large truck. The force, F, that pulls the equipment horizontally is given by the equation

$$F = T\cos\theta,$$

where T is the tension on the cable, in newtons, and θ is the angle of elevation of the cable. The angle of elevation of the cable is $14°$ and the tension on the cable is $4\ 600$ N.

Numerical Response

2. The force, F, that pulls the piece of equipment horizontally, correct to the nearest newton, is _____ N.

(Record your answer in the numerical-response section on the answer sheet.)

An engineer is testing the force on a bulldozer blade as it impacts hard soil at different speeds. He measures the force for a stopping distance of 2 cm and records the data. The engineer plots the data from the 2 cm test on the graph shown below.

Stopping Distance = 2 cm					
Speed (m/s)	0	1.0	2.0	3.0	4.0
Force (MN)	0	0.5	1.8	4.1	7.0
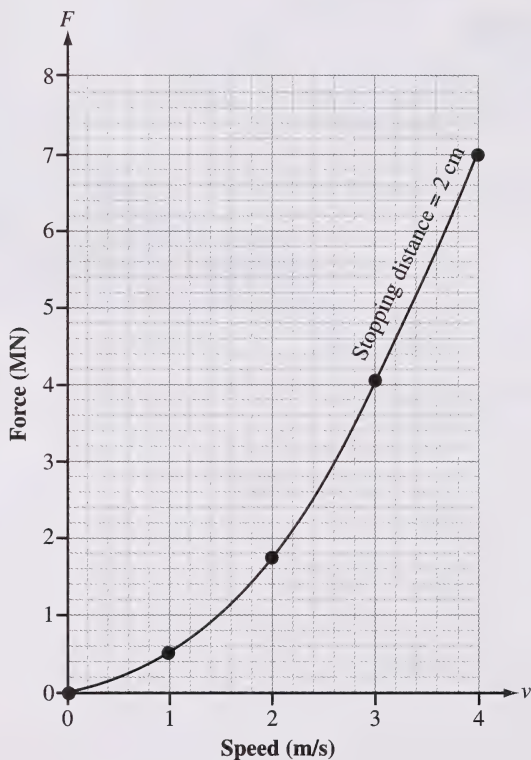
Written Response—5 marks

2. **a.** Estimate, to the nearest tenth of a meganewton (MN), the force on the blade when the speed of the bulldozer is 2.8 m/s.

b. • The engineer performs a second test. He measures the force for a stopping distance of 6 cm and records the data, as given below. Plot the data from the 6 cm test on the graph on the previous page. Draw the curve through the data.

Stopping Distance = 6 cm					
Speed (m/s)	0	1.0	2.0	3.0	4.0
Force (MN)	0	0.2	0.6	1.4	2.4

• The engineer states that the relationship between force and speed is quadratic. Identify a similarity and a difference between the two curves.

• The engineer observes that each of the two graphs is a partial parabola and that each can be described by an equation of the form $F = av^2$, where F represents the force, in meganewtons, and v represents the speed, in metres per second. Find the equation of the parabola formed by the results of the 6 cm test.

RECREATION

People working in the tourism industry apply mathematics in a variety of ways. The next set of questions will require you to apply your mathematical background to questions and problems related to a ski resort in Alberta.

The table below shows a linear relationship between the number of ski rentals at a ski resort and the total money collected for the rentals.

| Number of rentals	3	6	9
Total rent collected	$54	$108	$162

Numerical Response

3. If $270 was collected, then the number of ski rentals was _____.

(Record your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next two questions.

In planning the seating in a new chalet cafeteria, the manager of the ski hill compared the current number of seats per cafeteria to the total seating area in several resorts. This relationship and a line of best fit for the data are shown in the scatter plot below.
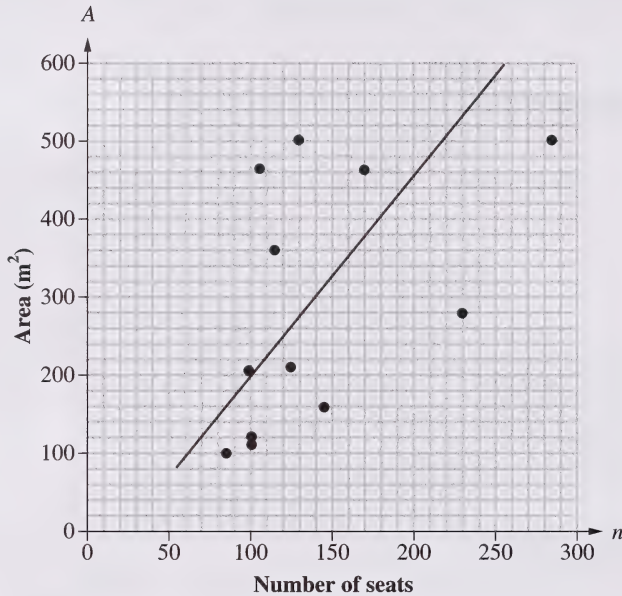
Numerical Response

4. According to the equation for the line of best fit, $A = 2.55n - 55$, the area required for 265 seats, to the nearest square metre, is _____ m^2.

(Record your answer in the numerical-response section on the answer sheet.)

7. According to the line of best fit, the number of seats that should be placed in a 280 m^2 location, to the nearest 10 seats, is

A. 260
B. 230
C. 160
D. 130

14

At the ski hill, the daily lift-ticket price for students is $35.00. The table below indicates the total amount that a student spent on lift tickets over a period of three days.

Number of days	1	2	3
Cost of lift tickets	$35	$70	$105

8. The type of relationship shown in the table is

A. linear
B. quadratic
C. reciprocal
D. exponential

Use the following information to answer the next two questions.

The number of skiers, n, who visited the ski resort each day for the month of February, d, was recorded and graphed, as shown below.


Day of month
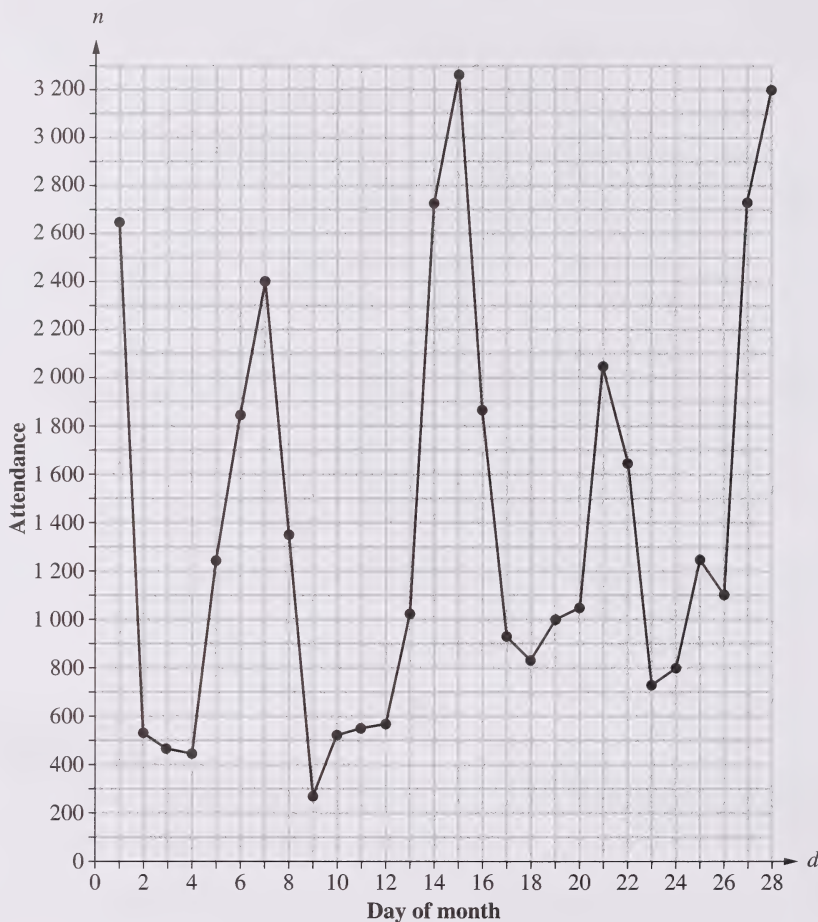
9. Management at the ski resort set a goal to collect $60 000 or more in revenue each day in February. If each skier spent an average of $60 per day at the resort, then the goal was reached on all of the following days **except**

A. February 7
B. February 17
C. February 19
D. February 28

10. The range of this graph is

    A. $1 \le d \le 28$

    B. $1 \le n \le 28$

    C. $280 \le n \le 3\ 260$

    D. $280 \le d \le 3\ 260$

Use the following information to answer the next question.

At the ski resort, an avalanche gun is used to loosen snow buildup. On the coordinate plane below, the position of the avalanche gun is represented by the origin, *O*. The position of the summit that the gun is aimed at is represented by point *P*(–285, 340).
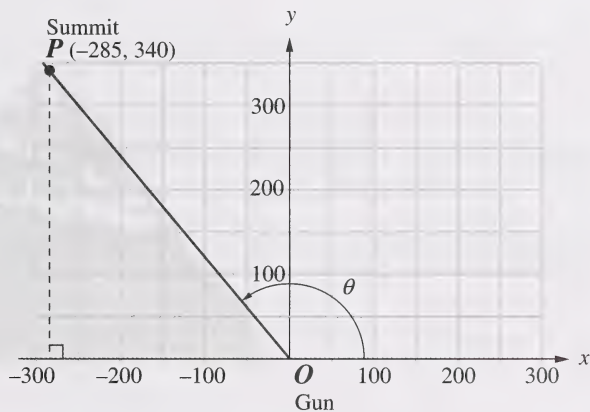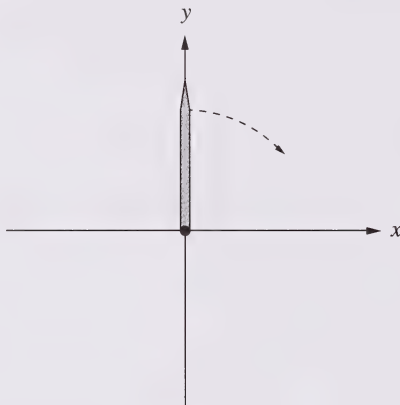

11. The measure of angle θ, to the nearest degree, is

    A. 130°

    B. 123°

    C. 57°

    D. 50°

A water equivalency meter measures the percentage of water that a sample of snow produces when melted. When a particular sample was measured, the meter rotated in a **clockwise direction** from a vertical position, as shown below.

12. If the meter rotated 170° from the vertical position, its final position was in

A. quadrant 1
B. quadrant 2
C. quadrant 3
D. quadrant 4

Numerical Response

5. Out of 20 samples of snow taken when the air temperature was −5°C, 16 samples had a water equivalency recording of 30% or more. Based on a 90% confidence interval, the percentage of samples taken when air temperature is −5°C that will have a water equivalency of 30% or more is expected to be between 60% and _____%.

(Record your answer in the numerical-response section on the answer sheet.)

A snow-grooming machine can be purchased for $235 000. Management at the ski resort is considering taking out a loan at 6% per annum, compounded monthly, to pay for the machine.

13. If the management plans to make monthly payments of $7 149, the amortization period will be

A. 3 years

B. 2 years

C. 1.5 years

D. 1 year

At the ski resort, there is a rectangular parking lot that measures 250 m by 50 m. To increase the area of the parking lot to 15 600 m^2, a uniform strip x metres wide will be added to two sides, as shown below.
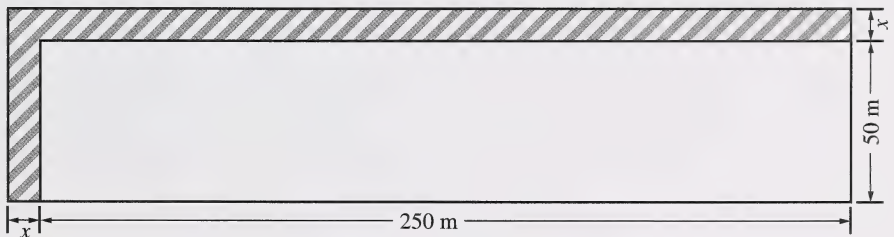
14. An equation that could be used to determine x is

A. $(250 - x)(50 + x) = 15\ 600$

B. $(250 + x)(50 - x) = 15\ 600$

C. $(250 - x)(50 - x) = 15\ 600$

D. $(250 + x)(50 + x) = 15\ 600$

One of the special features of the ski resort's snowboard terrain park is a series of four "rollers" whose surfaces have the shape of a sine function, as shown below.
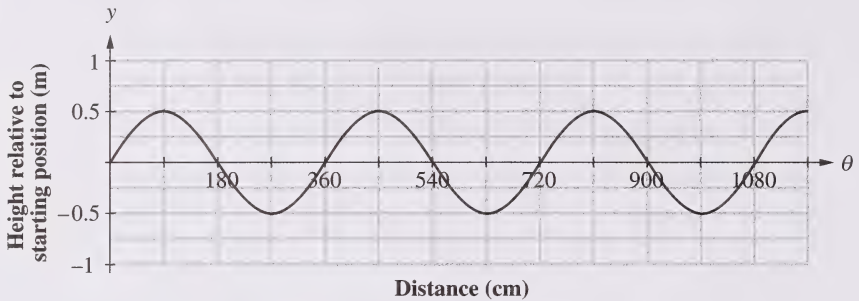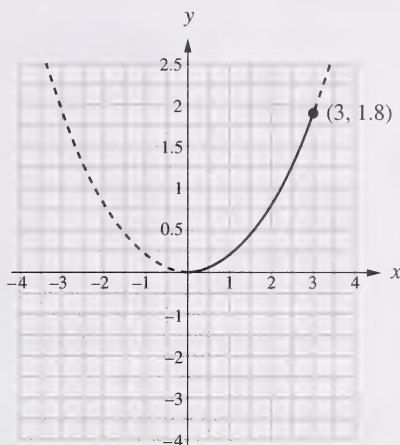

15. A function that describes these rollers is

A. $y = \sin 4\theta$
B. $y = 4 \sin \theta$
C. $y = \sin 0.5\theta$
D. $y = 0.5 \sin \theta$

20

The snowboard terrain park features several "quarter pipes." A quarter pipe is created by moulding snow into the shape of a partial parabola, as modelled in the graph below. This shape can be represented by the function $y = ax^2$.

16. If point $(0, 0)$ and point $(3, 1.8)$ represent the vertex and the top of the snow bank respectively, then a quadratic function that represents the shape of the quarter pipe is

A. $y = 2x^2$

B. $y = 0.2x^2$

C. $y = 6x^2$

D. $y = 0.6x^2$

An employee at the ski resort borrowed $5 000.00 at 12% per annum, compounded monthly. To repay this loan, he made monthly payments of $235 for 2 years. The following amortization table shows some entries of his repayment schedule.

| Payment Number | Previous Balance | Monthly Payment | | Outstanding Balance |
		Interest Paid	Principal Paid	
0				$5 000.00
1	$5 000.00	$50.00	$185.00	$4 815.00
2	$4 815.00	$48.15	$186.85	$4 628.15
3	$4 628.15	$46.28	$188.72	$4 439.43
4	$4 439.43	$44.39	$190.61	$4 248.82
5	$4 248.82	$42.49	$192.51	$4 056.31
6	$4 056.31	$40.56	$194.44	*A*
7	*B*	*C*	*D*	*E*

Note: Each monthly payment is the sum of the principal and the interest.

Written Response—5 marks

3. **a.**   • Some of the values for payment 1 that would appear in the equation to calculate the outstanding balance are shown below. Complete the entries to verify the outstanding balance after payment 1.

Previous Balance	+	Interest Paid	–	Monthly Payment	=	Outstanding Balance
$5 000.00	+		–		=	$4 815.00

   • Determine the outstanding balance, *A*, after payment 6.

b. • Determine the values of **B**, **C**, **D**, and **E** in the table. Use the space below the table to show your calculations.

6	$4 056.31	$40.56	$194.44	
7				

• If the employee were able to borrow the $5 000 at **9%** per annum, compounded monthly, instead of 12% per annum, compounded monthly, what is one characteristic of the repayment schedule that would change? Explain the effect that this change would have on the loan.

The original speed of a 2 400 m long chairlift is given by x m/min. When the original speed is increased by 60 m/min, it takes 2 min less to get to the top of the ski hill.

An equation describing the difference between the original time required to get to the top of the ski hill and the new time required to get to the top of the ski hill is

$$\frac{2\,400}{x} - \frac{2\,400}{x + 60} = 2$$

To solve for the original speed, x, this equation can be rewritten as the quadratic equation $x^2 + 60x - 72\,000 = 0$.

17. The solutions for x in the quadratic equation above could be given by

A. $x = \dfrac{-60 + \sqrt{291\,600}}{2}$

B. $x = \dfrac{-60 + \sqrt{284\,400}}{2}$

C. $x = \dfrac{60 + \sqrt{291\,600}}{2}$

D. $x = \dfrac{60 + \sqrt{284\,400}}{2}$

CONNECTIONS

For the next set of questions, you can transfer the skills and procedures learned in simplifying fractions and polynomial expressions to working with rational and radical expressions. You can also apply your knowledge of annuities, mortgages, and loans.
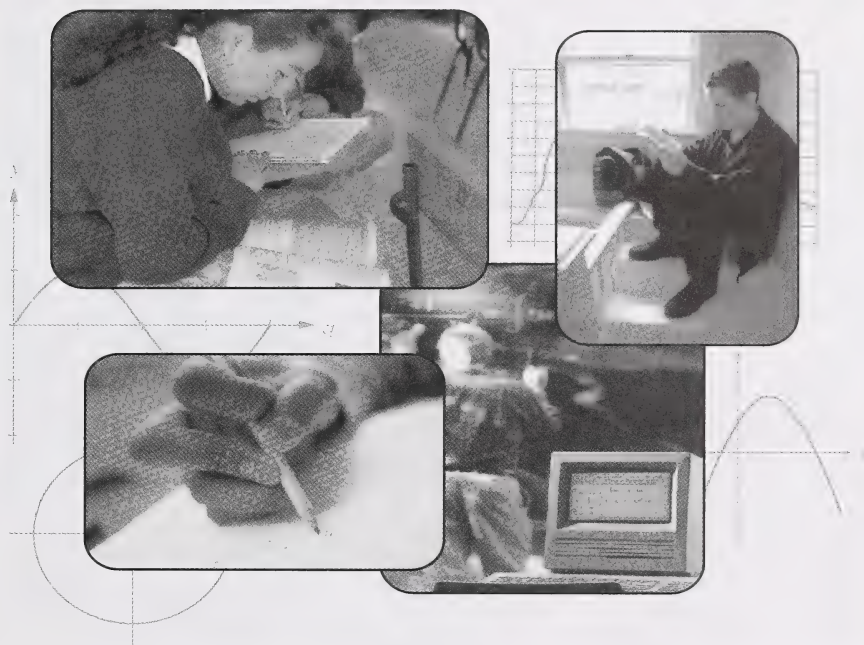
6. If the data booklet tables are used to determine the present value of an annuity invested at 8% per annum, compounded quarterly for 3 years, then a person should refer to the column labelled _____%.

(Record your answer in the numerical-response section on the answer sheet.)

Use the following information to answer the next question.

A woman invested $200 every year into an annuity earning 5% interest per annum, compounded annually. The woman created the following spreadsheet to calculate the amount of this annuity.

Previous Balance	Payment	Interest Rate	Interest	New Balance
$0	$200.00	0.05	$10.00	$210.00
$210.00	$200.00	0.05	$20.50	$430.50
a	*b*	*c*	*d*	*e*

18. To obtain the new balance, *e*, the woman could use the formula

A. $e = a + d$
B. $e = b + d$
C. $e = a + b + c$
D. $e = a + b + d$

26

> The "Monthly Payment on a $1 000 Mortgage" chart shows that for every $1 000 mortgaged at the rate of 8% per annum, the bank requires a $12.06 monthly payment.

19. At $12.06 per month, a $1 000 mortgage would be paid in full in

    A.   10 years
    B.   15 years
    C.   20 years
    D.   25 years

> The mixed radical $2\sqrt{3}$ may be expressed as the equivalent entire radical $\sqrt{12}$, where 12 is known as the radicand.

20. If $7\sqrt{3}$ and $3\sqrt{13}$ are both expressed as entire radicals, the **smaller** radicand of the two expressions is

    A.   147
    B.   117
    C.   13
    D.   3

21. An equivalent form of the radical expression $\dfrac{3\sqrt{10}}{\sqrt{18}}$ is

    A. $2\sqrt{5}$

    B. $\sqrt{10}$

    C. $\sqrt{5}$

    D. $\dfrac{\sqrt{5}}{2}$

22. If the expression $\sqrt{27} + 3\sqrt{5} - 3\sqrt{20} + 2\sqrt{3}$ is simplified to the form $a\sqrt{b} + 5\sqrt{3}$, where a and b are integers, then the value of a can be

    A. -9
    B. -3
    C. 6
    D. 9

23. The rational expression $\dfrac{x-a}{x(x-2)(x+b)}$ is not defined when x is equal to

    A. -2 or b

    B. 2 or $-b$

    C. 0, -2, or b

    D. 0, 2, or $-b$

Use the following information to answer the next question.

In order to simplify the rational expression $\dfrac{x^2 + 7x + 12}{x^2 + 4x + 3} \div \dfrac{x^2 + 4x}{x^2 + x}$, where $x \ne -4, -3, -1, 0$, three steps were followed.

The three steps are listed below but are **not** organized sequentially.

Step 1 $\quad \dfrac{x^2 + 7x + 12}{x^2 + 4x + 3} \times \dfrac{x^2 + x}{x^2 + 4x}$

Step 2 $\quad \dfrac{\cancel{(x+3)}\cancel{(x+4)}}{\cancel{(x+3)}\cancel{(x+1)}} \times \dfrac{x\cancel{(x+1)}}{x\cancel{(x+4)}}$

Step 3 $\quad \dfrac{(x+3)(x+4)}{(x+3)(x+1)} \times \dfrac{x(x+1)}{x(x+4)}$

Numerical Response

7. Listed in the correct order, the three steps are _____, _____, and _____.

(Record **all three digits** of your answer in the numerical-response section on the answer sheet.)

24. If $\dfrac{2}{(x-1)} - \dfrac{3}{(x+2)}$, where $x \neq 1$ or -2, is simplified, then the denominator is

A. $x^2 - 2$

B. $x^2 + x - 2$

C. $x^2 - 2x + 2$

D. $x^2 + 4x + 4$

25. In the equation $\dfrac{5}{x+1} + \dfrac{2}{3} = 1$, where $x \neq -1$, the value of x is

A. 20

B. 15

C. 14

D. $\dfrac{3}{4}$

8. When $\dfrac{5x-1}{4} + \dfrac{2-3x}{7}$ is simplified and written in the form $\dfrac{ax+b}{28}$, the value of a is _____.

(Record your answer in the numerical-response section on the answer sheet.)

26. An equivalent form of the rational expression $\dfrac{(6x+5)(x-4)}{x^2+x-20} \times \dfrac{x^2-25}{36x^2-25}$, where x cannot represent a number that makes the denominator equal to 0, is

A. $\dfrac{x+5}{6x-5}$

B. $\dfrac{x-5}{6x-5}$

C. $\dfrac{x+5}{6x+5}$

D. $\dfrac{x-5}{6x+5}$

27. If the graph of $y = x^2$ were shifted left 7 units and up 4 units, then the axis of symmetry of the transformed graph would be

A. $x = 7$
B. $x = 4$
C. $x = -4$
D. $x = -7$

31

A student used the following steps to complete the square of the quadratic function $y = x^2 + 6x - 6$.

Step 1	$y = (x^2 + 6x) - 6$
Step 2	$y = (x^2 + 6x + 9) - 6 + 9$
Step 3	$y = (x + 3)^2 + 3$
Step 4	The vertex is $(-3, 3)$

28. The student first made an error in

A. step 1
B. step 2
C. step 3
D. step 4

_____

Four graphs of $y = ax^2$ are shown below.
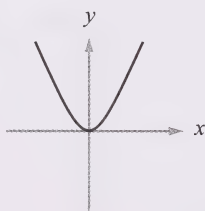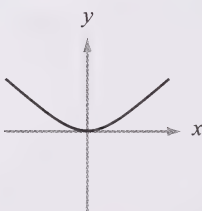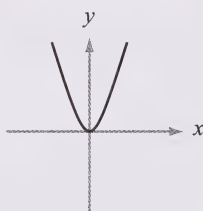
Graph 1   Graph 2   Graph 3   Graph 4
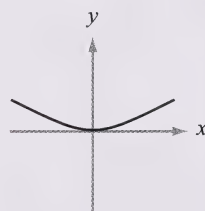
Numerical Response

9. When the graphs are arranged so that the values of a are listed from **smallest to largest**, their order is _____, _____, _____, and _____.

(Record **all four digits** of your answer in the numerical-response section on the answer sheet.)

The graph of the function $y = a(x - b)(x - c)$ is shown below.
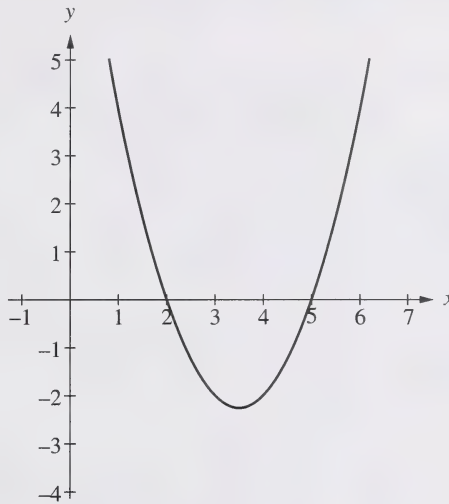
29. An equation that could represent this function is

A. $y = -1(x + 2)(x + 5)$
B. $y = -1(x - 2)(x - 5)$
C. $y = 1(x + 2)(x + 5)$
D. $y = 1(x - 2)(x - 5)$

FARMING

Farming requires various mathematical skills such as reading and interpreting graphs, and applying formulas, statistics, and trigonometry.

The front-end loader on a tractor is powered by a hydraulic system. In order to move a volume Q of hydraulic oil at a speed v through the system, the hydraulic lines must be a particular diameter, d, that can be determined through the formula

$$d = \sqrt{\frac{21Q}{v}}$$

30. An equivalent representation of this formula is

A. $v = \dfrac{21Q}{d^2}$

B. $v = \dfrac{21Q}{\sqrt{d}}$

C. $Q = 21dv$

D. $v^2 = \dfrac{441Q}{d^2}$

A tractor wheel is secured by 12 lug nuts equally spaced around the wheel, as shown below.
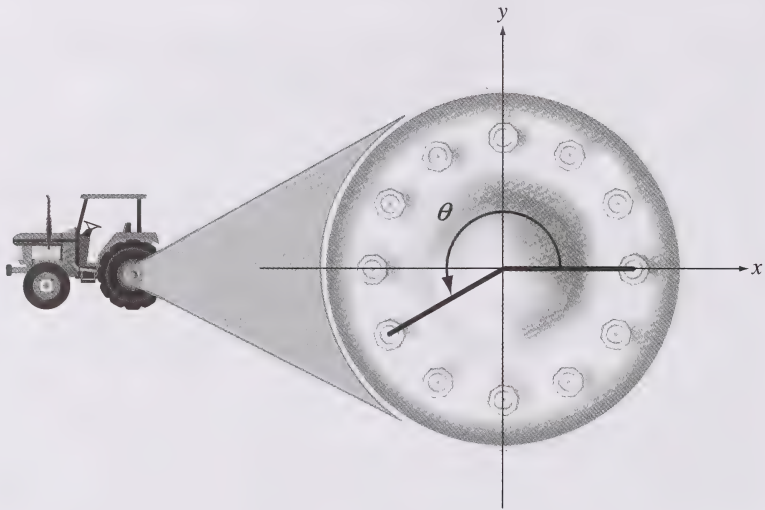
The angle of rotation, θ, between the centres of two particular lug nuts is indicated in the diagram.

31. Angle θ, correct to the nearest degree, is

A. 30°
B. 150°
C. 210°
D. 240°

A particular tractor has a steering column that can be moved to various positions. When the tractor is parked, the steering column is put in a vertical position. When the tractor is being driven, the steering column can be rotated downward and pushed inward. In the diagram below, lines are drawn through the centre of the steering column as indicated by segments $\overline{AB}$ and $\overline{AC}$.
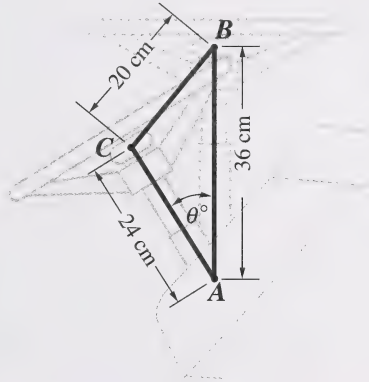
32. The angle θ, through which the steering column moves from the vertical position to the driving position, to the nearest degree, is

A. 48°

B. 40°

C. 34°

D. 32°

An agriculturalist graphed the relationship between the average root depth of canola plants, in centimetres, and the number of days following planting, as shown below.
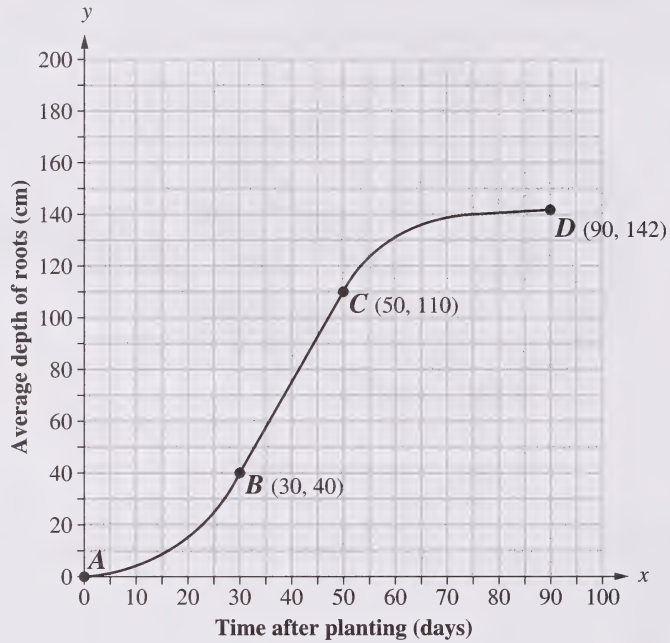

Written Response—5 marks

4. a. According to the graph above, the average length of time from planting, point *A*, to harvesting, point *D*, is _____ days.

b. During the period graphed between points B and C, the average rate of root growth was greatest, and it followed a linear pattern. Determine the slope of the graph between points B and C, and explain what this value means within the context of this problem.

c. Using evidence from the graph, explain what happened to the canola plants' roots during the period graphed between points A and B and during the period graphed between points C and D. Suggest **at least** one explanation of the growth pattern of the canola plants' roots during each of these periods.

On a particular farm, a wind generator produces electrical power. The voltage can be graphed as a sine curve, as shown below. This graph can be represented by the equation $y = a \sin b\theta$.
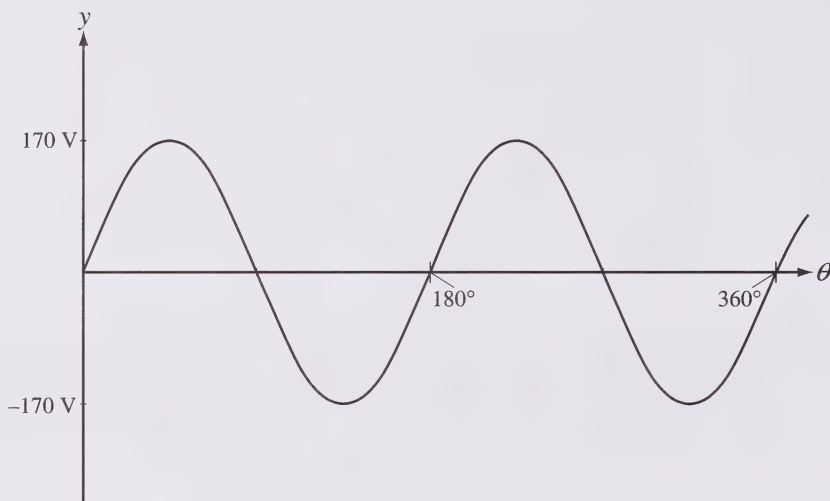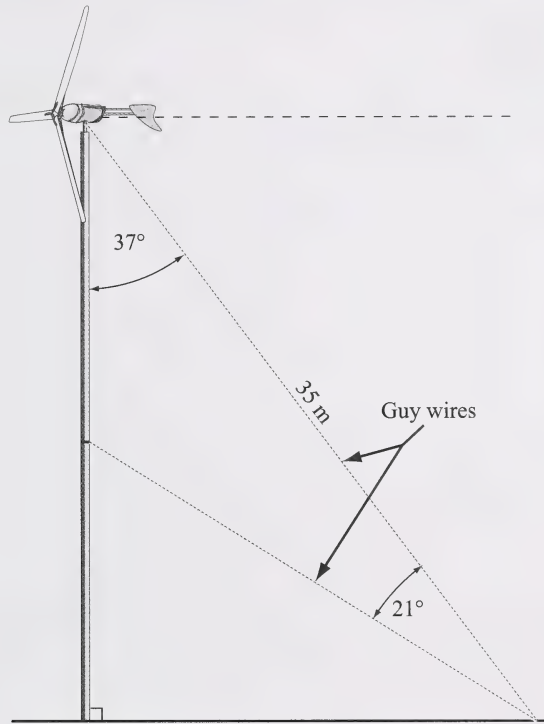

33. In the equation above, the value of b is

A.   2
B.   90
C.   170
D.   180

A wind-generator tower on a farm is supported by two guy wires, as shown below. The longer wire is 35 m long, and it forms an angle of 37° with the tower. The angle between the two wires is 21°.

37°

35 m   Guy wires

21°

Numerical Response

10. The length of the shorter guy wire, correct to the nearest tenth of a metre, is _____ m.

(Record your answer in the numerical-response section on the answer sheet.)

The electrical power, P, in watts, produced by a particular wind generator is related to wind speed, s, in kilometres per hour, by the formula $s = \sqrt[3]{74.8P}$.

Numerical Response

11. If the wind generator produces 365 W, then the wind speed, correct to the nearest tenth of a kilometre per hour, will be _____ km/h.

(Record your answer in the numerical-response section on the answer sheet.)

An agricultural scientist wants to compare how the growth rate of two grass crops, timothy and alfalfa, is related to the mean daytime temperature, in degrees Celsius, throughout the growing season. He measures growth rate in kilograms of sugar per hectare per hour and graphs his findings, as shown below.
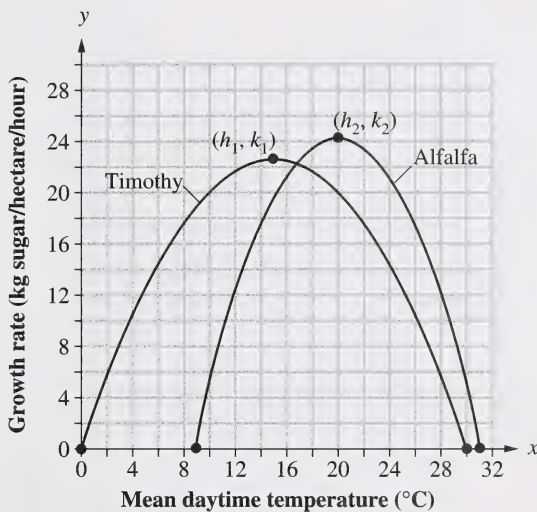

The vertex of the graph describing the growth rate of timothy grass is represented by (h_1, k_1), and the vertex of the graph describing the growth rate of alfalfa grass is represented by (h_2, k_2).

34. The relationships between these values are

A. $h_1 > h_2$ and $k_1 < k_2$

B. $h_1 < h_2$ and $k_1 < k_2$

C. $h_1 > h_2$ and $k_1 > k_2$

D. $h_1 < h_2$ and $k_1 > k_2$

A farmer wants to plant sunflower seeds in rows that are 1 m apart. To determine the rate of seeding for sunflowers, the farmer analyzes the relationship between the seed spacing in each row, in metres, and the expected sunflower plant density, in plants/m^2, as shown in the graph below.
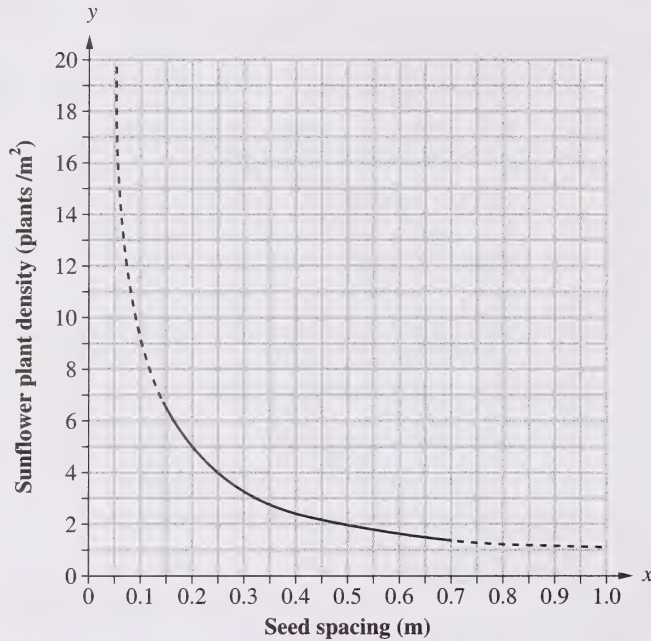

Numerical Response

12. If the farmer wants to get a sunflower plant density of 5 plants/m^2, then the seed spacing in each row, correct to the nearest tenth of a metre, needs to be _____ m.

(Record your answer in the numerical-response section on the answer sheet.)

Plant growth is affected by the concentration of chlorides and nitrates in soil. One of the graphs below shows a scatter plot and line of best fit for chloride concentration in relation to crop yield. The other graph shows a scatter plot and line of best fit for nitrate concentration in relation to crop yield.
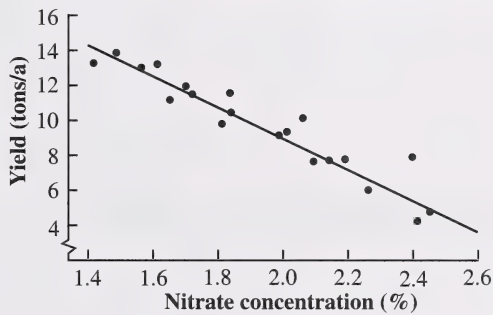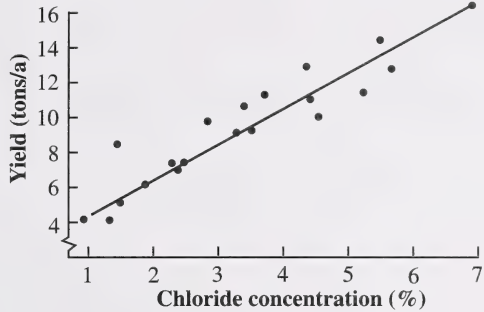
35. According to these graphs, the soil that should produce the greatest crop yield has

A. high chloride concentration and low nitrate concentration

B. high chloride concentration and high nitrate concentration

C. low chloride concentration and low nitrate concentration

D. low chloride concentration and high nitrate concentration

The relationship between the oil content (%) and the protein content (%) of canola seeds being purchased by a canola-processing plant is shown in the scatter plot below.
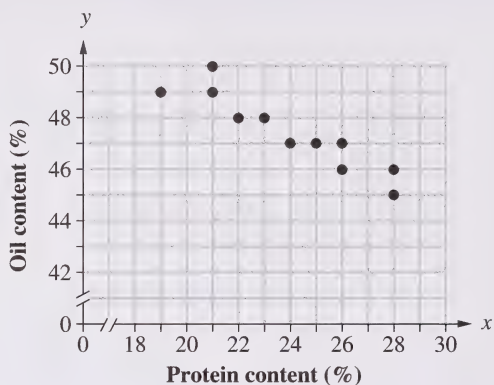
According to the scatter plot, the correlation is ____*i*____ , and as the protein content of canola increases, the oil content of canola ____*ii*____ .

36. The statement above is completed by the words in row

	i	*ii*
A.	positive	decreases
B.	negative	decreases
C.	positive	increases
D.	negative	increases

To solve the quadratic equation $5x^2 - 10x - 21 = 0$, a student used the quadratic formula and got the following partial answer.
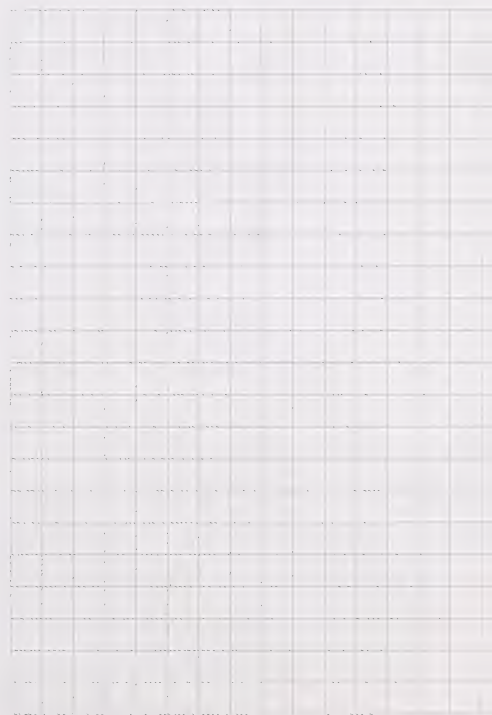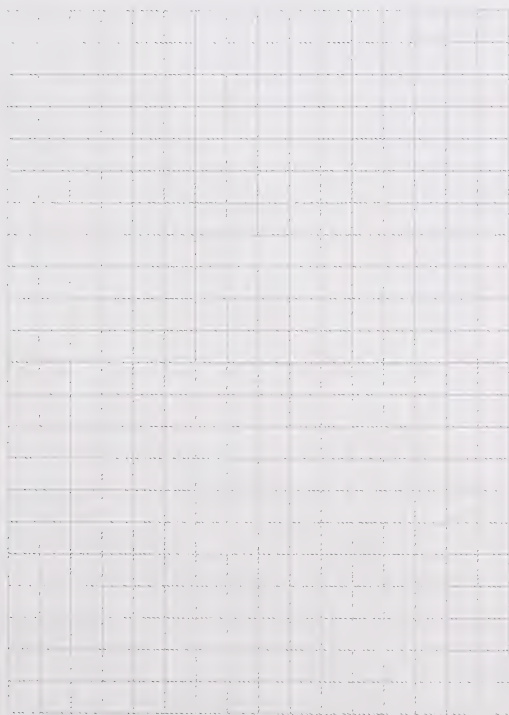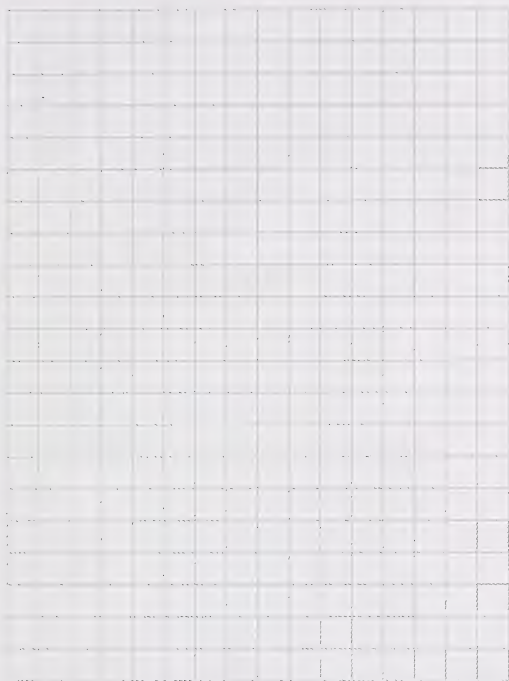
$$x = \frac{10 \pm \sqrt{100 - 4ac}}{2a}$$

37. In this equation, the values for x, to the nearest hundredth, are

A. 3.28 and −1.28

B. 8.21 and −6.21

C. 23.80 and −21.80

D. 32.80 and −21.80

You have now completed the examination.
If you have time, you may wish to check your answers.

Fold and tear along perforation.

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Mathematics 33
January 2001

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